
ECLIPSE

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It casts a big shadow—with 16 feet of wing it should! Designed specifically for extended duration, the Eclipse will ride thermals almost forever. / by Hal Cover

Why a glider with a 180" span and the name Eclipse? You will understand the first time it flies over your head with its gracefulness and beauty. When it lands the size becomes very apparent, and you might even expect a pilot to climb out looking for his glider trailer.

In comparing the performance of the Eclipse to a smaller version, interesting performance variations appeared. First it flew in much higher winds than the smaller one, even though both had an 8 oz./sq. ft. wing loading. Also, still air flight times were as much as 50% better with the larger model. Probably the larger glider's only weakness is that it is hard to pick up thermals at low altitude. The relatively large tail and long tail moment contribute to its extremely stable flight characteristics.

In calm weather, flights of up to ten minutes have been made without aid of the controls—in other words, free flight. . .that includes the launch, too! If the plane is allowed to fly straight, it will turn into lift by itself and stay in lift; so

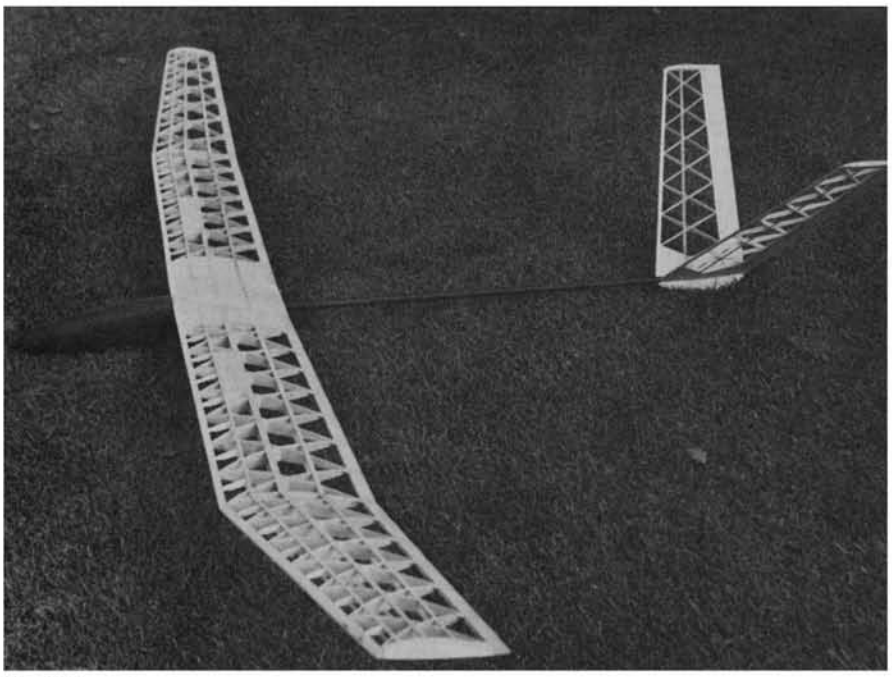
(Continued on next page)

let it find the lift for you. The spoilers are just effective enough to allow a good controlled sink, with only up trim needed for proper attitude. This makes spot landings a cinch.

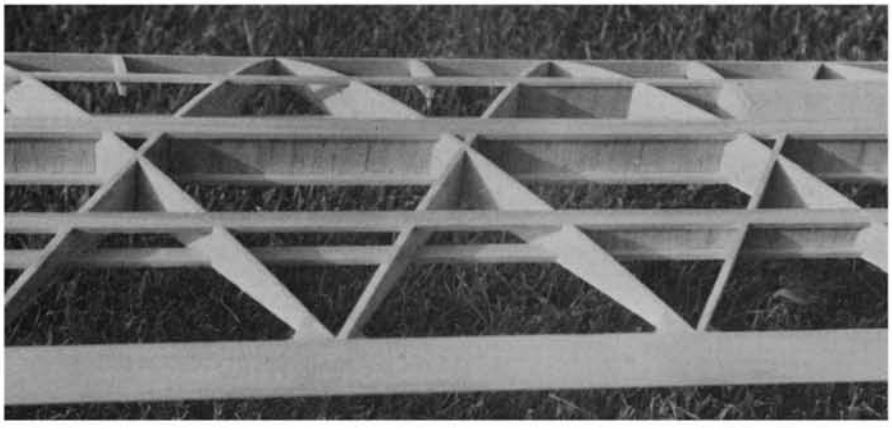
The spoilers proved their worth on one flight where the plane rode a thermal until it disappeared in the clouds. At this point, the spoilers were opened and a large circle set in the controls. Without further action, the plane came down safely. . .but it took half an hour! This plane is big, and therefore can't be treated like a small plywood and foam glider. If it gets way up in a thermal, use the spoilers and up trim; don't dive it or spiral it in because the plane picks up speed fast and it is not indestructible.

Locating a fiberglass tailboom for the Eclipse may pose a problem for prospective builders. However, there are several approaches one can take. First, as the author did, contact your local sporting goods store and have them recommend a fishing pole manufacturer from whom you can make a selection.

If no manufacturer is readily available, perhaps the sporting goods store will order one for you. The fiberglass rod should be about seven-nine ounces in weight, eight to nine feet long and have a diameter of approximately 1¼" at the large end. If you have difficulty with either of these approaches, contact me, c/o **AAM**, and I'll supply you with a boom equivalent to the one used on the original Eclipse.



The Eclipse is not, as it looks, a myriad of little pieces—it's a myriad of big pieces! Using geodetic construction is the only way to build a 16-foot soarer with a reasonable wing loading and good strength.



Detail shot of the wing structure shows spar webbing and warren truss ribs.

CONSTRUCTION

Building Tips: Always use spruce wherever shown—don't substitute balsa. Web all areas indicated with hard balsa. The wing and stab structures require a web for necessary structural properties.

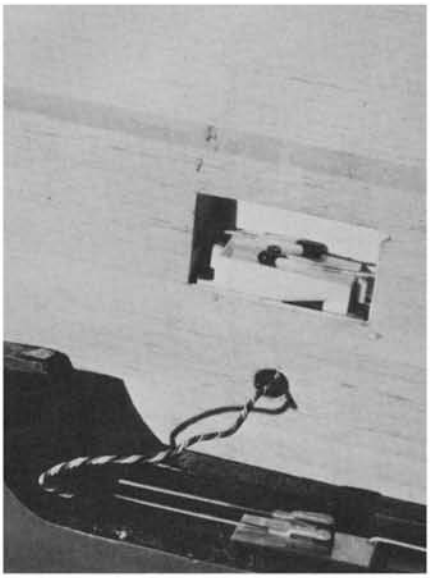
The wing center section needs the 1/16" piano wire and fiberglass cloth covering on the trailing edge; it is also recommended that the center section leading edge and tip dihedral leading edge and trailing edge joints be fiberglassed. Use epoxy and glass cloth as needed wherever wire hooks or tubing are installed.

Fuselage Construction: The fuselage is constructed from medium balsa sheet and blocks. The sides are cut from 3/4 x 5 x 24" sheet, the nose block is 9 x 2 x 4" and the rear fuse block is 5 x 2 x 8". 3/4 x 2 x 12" sheet is used on the top and bottom. The tailboom size may vary depending upon what is available, but the author's plane had a boom 50" long, 1" in diameter tapered to 1/2" diameter.

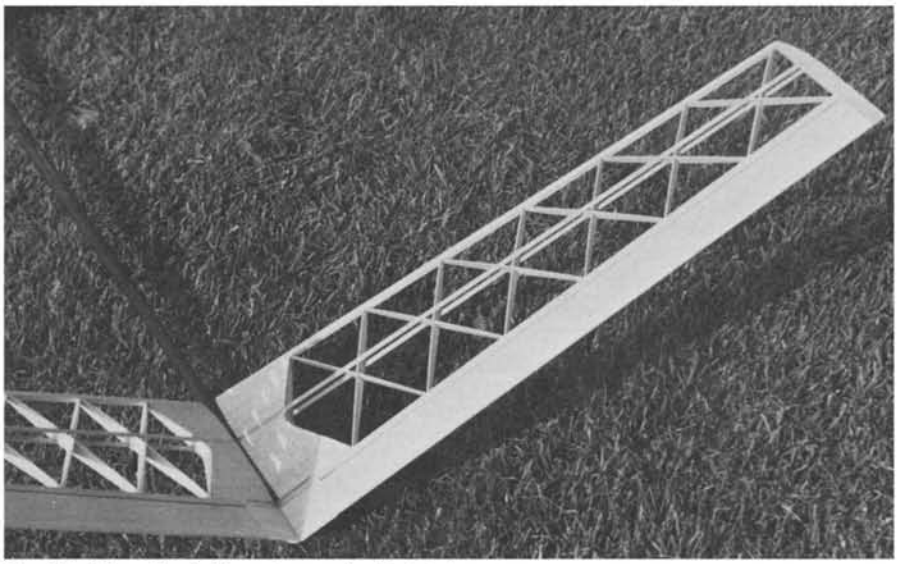
Cut out the blocks as shown on the plans. Glue the blocks, top and bottom sheet to a side sheet. When dry, sand the edge of the unplanked side to obtain a good flush joint. Glue the second side in place. Don't carve the fuselage to the correct cross section until the tailboom is installed.

Tailboom Installation: The tailboom installation is critical and should be done carefully. Place the fuselage upside down on a flat surface at least six feet long. Block up the wing mount platform to the correct incidence angle, as follows: The leading edge portion of the wing platform (at former B) should be 1" off the bench, and the trailing edge should be 1-9/16" off the bench. This will position the wing platform on the fuselage at the correct incidence angle, with the bench surface representing 0°.

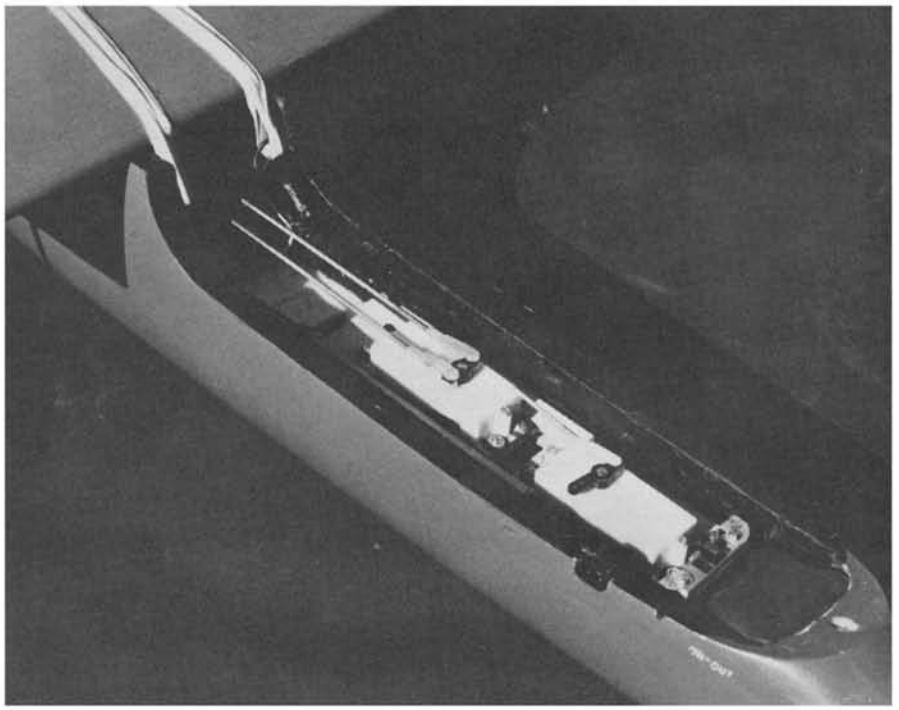
In the next operation, the tailboom is going to be used as a drill. Carefully sharpen the large end by chamfering the inside, as shown on the plans. Alignment of the boom is achieved by blocking the small end of the boom to the same height (1-9/16") above the table as the trailing edge portion of the fuselage—the boom is now at 0° also. A straight line drawn on the bench may be used for boom alignment left to right. With the fuselage and boom held in the proper position on the locating blocks, push the boom into the block and drill by rotating with a fair amount of pressure. Once the boom is into the block about one inch, the assembly may be removed from the bench to finish the boring operation. This method may seem a bit strange, but it gives an accurately aligned and tight fitting boom. Remove the boom from the fuselage,



The modular wing center section houses the spoiler servo. The model disassembles very quickly and stores easily with this arrangement.



The V-tail is ultra-light, yet rugged. Minimizing drag on a 50" tail moment is critical to maneuverability.



The slender pod decreases drag. The back servo slides on a tray. The link to the forward servo is drilled right into the servo case top.

take the plug out of the boom and reinstall with five-minute epoxy.

Carve the fuselage, using the templates shown for correct contour. Then cut out the cockpit with a band saw or coping saw.

Cut the plywood skid from 1/8" plywood and bond to the fuselage. With the canopy in place, cover the entire fuselage with one layer of one-ounce glass cloth. Put an additional two layers on the nose and bottom of the fuselage, including the skid. Remove the canopy and grind out the nose block as shown with a Moto-Tool or similar device. The canopy can be held in place using several methods. The original was held with a locating dowel in the front and snaps in the rear.

Servo Installation: The servo tray is made from 3/32" plywood. The servo cutout size will depend on the servos used. The sliding servo is mounted to two pieces of 3/32" plywood: 1/4" x servo width, plus 1/4". The guides for the sliding servo are made by cementing 3/32" sq. hardwood to the strip on both sides, 1/8" away from the servo cutout. Glue a strip of 1/16 x 3/16" hardwood on top, with the overlap to the servo side. When cementing this assembly, make sure the sliding servo can move freely up and down the tray slide.

Towhook Installation: The towhook is made from soft .032 aluminum and 1/16" wire. Bend the wire to shape and cut out the 1/4 x 2 x 5/8" plywood support. Place the piano wire in the fuselage as shown. Slip the aluminum hook in place and bolt to the skid using 4-40 bolts.

Wing Hook Installation: These are formed from 1/16" piano wire and epoxied to the side of the fuselage, as shown. For additional strength, cover them with two layers of glass cloth and epoxy.

Do as much finishing work as possible on the fuselage prior to stab installation, because of the sheer size and awkwardness of the fuselage/stab assembly.

Stab Construction: Only half the stab is shown on the plans but, since the airfoil is symmetrical, build two halves on the plan and flip one over for the other half.

Using blocks, pin the leading edge and trailing edge in place 1/4" above the plans at the center and 1/8" above at the tip. Cut out the ribs using the template shown. Note that half of the ribs are solid, or uncut, and zigzag to the tips. These should be installed first, followed by the installation of the cut ribs.

The method of obtaining the correct airfoil for all ribs is done as follows. Mark the 1/16" sheet balsa with the required rib length and the 1/4" leading edge and 5/16" trailing edge height. Use airfoil template "A" for the odd numbered ribs 1, 3, 5, etc., and template "B" for even numbered ribs. Lay the airfoil template on the sheet balsa with its leading edge placed so that the top mark just shows. Position the rear of the template in a similar manner, with the trailing edge mark just showing, then cut the top airfoil. Repeat the operation for the bottom surface.

Spar Installation: The tapered spruce stabilizer spars are installed by marking the spar location and width (mark both sides) on the inner rib (1) and the tip rib (13). Next lay an aluminum yardstick or straightedge over the front marks, and cut a notch 1/16" deep in all ribs. Move the yardstick to the back marks and notch again. Then cut out the material between the notches.

Turn over and repeat the operation on the bottom of the stab. Add the tip block and glue the spruce spars in place, but make sure there are one or two inches extra in the center for stab installation to the tailboom. Shape the LE and TE, then sand all ribs.

Stab Installation: Fit the leading and trailing edge to the boom carefully. Epoxy the dihedral brace (G) to the end of the boom, making sure it aligns with the wing platform. The spars will lay over and under, as shown on the plans, and should be butt jointed. When all items fit correctly, epoxy the stab halves to the boom again making sure it aligns with the wing platform. The hinge mechanism is bent to shape using 1/16" piano wire and 1/16" ID brass tubing. The lower portion of the hinge or clevis attachment is made from 1/8" ID brass tubing soldered to the wire and flattened. Drill a hole into the brass for the clevis.

The brass tubing portion of the hinge is epoxied to the rear spar. The fixed portion of the 5/16 x 2" trailing edge is notched to fit over the tubing and wire. The elevons can now be fitted and sanded, but not permanently attached (5/16 x 2" light aileron stock works well for the elevons, if available).

Web and stab spars using hard 1/16" sheet with the grain vertical (the web should run to half span), then sheet the top and bottom center section.

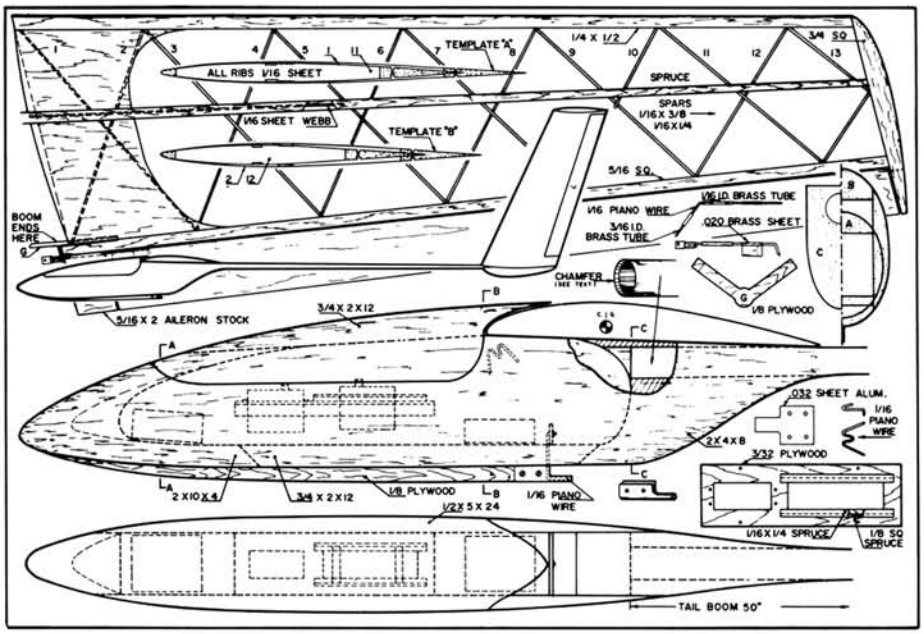
Pushrods: Carve out the pushrod holes as shown, and fabricate the pushrods from 1/4" hard balsa 48" long, with threaded clevis wire on both ends. The wire length is determined by the servo installation and hinge connection hole location. When the linkage is installed and working, one should get ± 40° travel out of each surface.

Tail Skid: Two 1/2 x 10 x 2" blocks can be cut to the shape you desire. These are then hollowed out for both linkage clearance and weight. Next, they are carefully fitted to the tailboom and glued in place. After final sanding, the tail skid should be covered with a layer of fiberglass cloth and resin.

Wing Construction—Inner Panels: The 28 inner panel wing ribs are cut from medium 1/8" sheet, using the diagonal rib template. The false ribs (5) are also cut from the same medium 1/8" sheet. All inner panel spars are spruce, with 1/8 x 1/2" used for the center spar, and 1/8 x 3/8" used for the front and back spars. Medium hard balsa wood should be selected for the leading edge and trailing edge. Before the wing is constructed, add 3/32 x 3/16" spruce to the back of the trailing edge. This strip is very effective protection against dings and cuts when building and flying.

Cut two number 3 ribs from 1/8" hard sheet balsa. Do not cut the ribs apart at each spar location until the spar has been installed in a later building step.

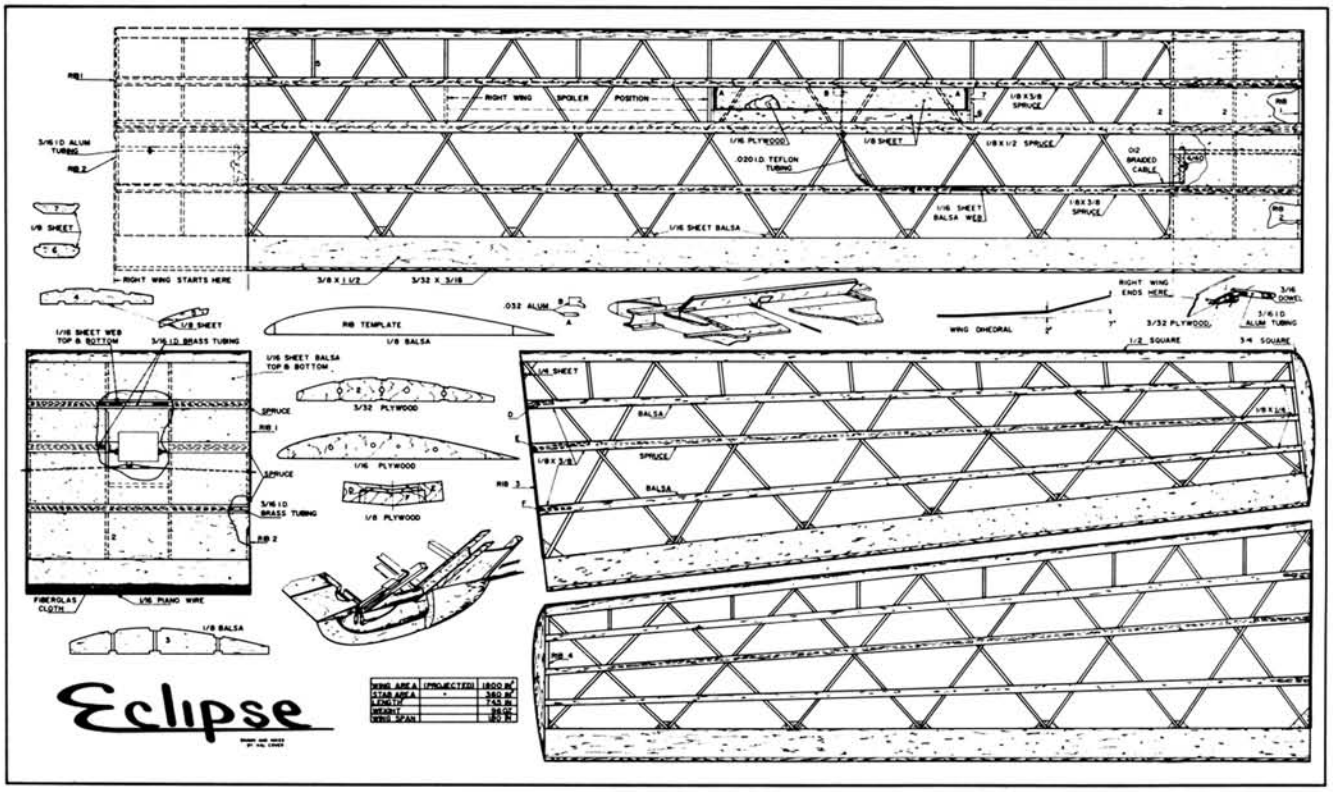
Pin the LE and TE down over the plans. Block up the plywood ribs 1/16" when installing to allow for the bottom sheet. Glue the geodetic ribs in place, noting which are continuous and which are cut in half when forming the geodetic structure. When the basic structure is dry, remove from the plans and build other inner panel in a similar manner.



Wing Tips: The tips are built using medium balsa for the LE and TE, and medium hard balsa for the front and back spars. The center spar is cut from 1/8 x 3/8" spruce.

Cut the wing tip ribs out of light 1/8" sheet balsa using the diagonal rib template. Use the same procedure for these ribs as used on the stabilizer ribs. Some ribs will be slightly thicker than necessary and must be sanded to the correct contour after the spars have been installed. The actual construction of the tips is done in the same manner as the inner panels.

Wing Dihedral: Pin or weight the inner panel down to the bench and block the tips up with 7" of dihedral. Sand carefully to fit, then glue together. Add rib 3 (still not cut apart). When dry, remove from the bench and carefully mark the spar locations on the tip rib 4. To notch out for the inner panel spars, lay an aluminum straightedge over the ribs, using the plywood rib notches and dihedral rib 3 notches for position reference. Cut a 1/8" deep notch in each rib-repeat this step until all spars are notched at both the front and back edges. Trim out all notches to 1/8" deep. Notch the tip ribs in a similar manner, except use the marks on rib 4, and the notches of rib 3 for spar location reference.



FULL-SIZE PLANS AVAILABLE - SEE PAGE 100

The spars should be glued in place 1/16" above the plywood ribs to allow for sheeting and be flush with all balsa ribs. Add the lower spars first. Cut out the spaces between rib 3 sections so that the 1/8" plywood dihedral braces D, E and F, can be installed. Next add the upper spars. When the spars are added to the tips you will find that some ribs are too high. These should be notched deep enough to allow the spars to be flush with the top of the lower or thinner ribs. Use a straightedge on top of the spars to make sure it is flat and not irregular due to incorrect spar notch depth. The center spar is webbed with hard 1/16" sheet balsa out to the center of the tips. The front and rear spars are webbed to the tip dihedral break. The grain of the web must run vertically if it is to be effective.

Spoilers: Laminate two pieces of 1 x 12 x 1/6" plywood to two pieces of soft 1/8 x 1 x 12" sheet balsa. Epoxy the hinges and horn to the plywood. Add the 3/16" ID aluminum tubing to the center ribs (2) and glue the 3/32" plywood bellcrank and mount in position. Set the spoiler in place and epoxy the hinge to rib 6, then glue rib 7 in place. Rib 7 acts as a stop, to locate the spoiler in the proper position when closed. Sand the upper surface of the spoiler (1/8" sheet) to match the upper airfoil contour. Epoxy the teflon or vinyl tubing in place as shown. Slide the 0.012 braided cable through the tubing and attach it to the spoiler horn and bellcrank. Then add a light tension spring to the spoiler, as shown, to hold the spoiler closed.

The action for opening the spoiler is quite simple. The servo, mounted on its side in the center section, pushes two rods out, which press against one end of a 3/16" dowel located inside the aluminum tubing of the inner wing panels. The dowel pushes against the bellcrank, which pulls on the cable and opens the spoiler. This system requires no actual center section-to-wing hookup. The worst problem that can occur in flight is, if the wings slide out on the rods a bit, the spoilers will only partially open when activated.

Wing Center Section: Slide four of the number 2 ribs on four brass tubes cut to the correct length (the center tube is two pieces, to allow for the servo mounting in the middle). Place on the plan and block up 1/16" to allow for sheeting. Coat all rib ends with glue and place the LE and TE in position. Hold them in place with pins or weights. When dry, remove from the plans and add all the spruce spars. Web the spars with 1/16" hard wood or plywood. Next install the servo and drill holes in each rib to allow the clevis rod to pass through and mate with the inner panel aluminum tubing/spoiler assembly. The entire top and bottom is sheeted with firm 1/16" sheet with only a cutout in the bottom sheet for servo access.

Wing Assembly: Position the brass tubes into the inner wing panels. Check alignment with the center section tubes. If all aligns, epoxy the tubes in place. Block off the end of each tube with a 1/2 x 1" piece of plywood, so that the tubing cannot be pushed into the wing. The tubes should then be webbed top and bottom with 1/16" spruce or plywood.

The author launches the mammoth beastie. The light wing loading makes hi-starts practical.

Assemble the wing, using six rods of piano wire 3/16" dia. approximately 7" long. Check out the spoiler mechanism and, if all works well, sheet the top and bottom of the inner panels with firm 1/16" sheet. Shape the leading edge and ribs to remove any burrs or rough spots on the wing surfaces.

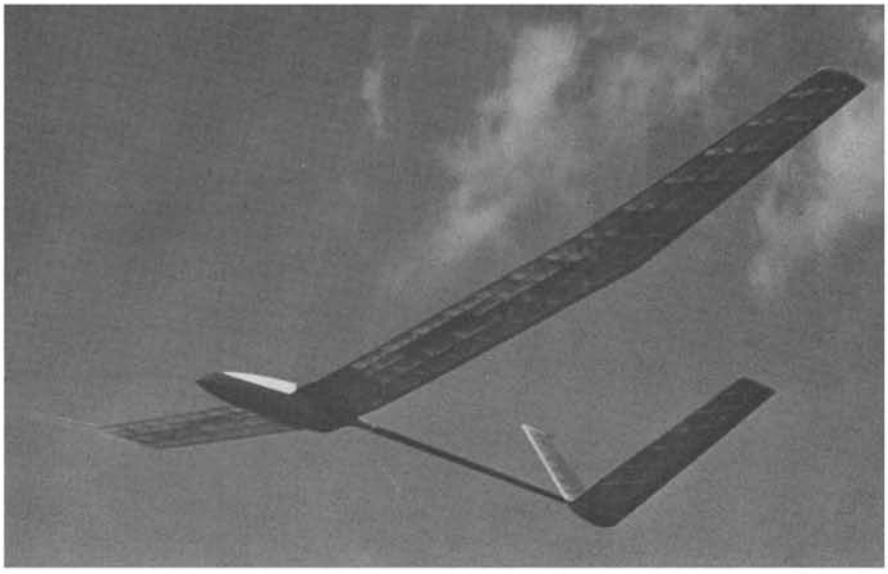
Covering: The covering is accomplished with the help of the Bank of America and four rolls of MonoKote. All surfaces are covered with normal MonoKote procedures. Cover movable surfaces before installation. The original Eclipse was covered with red MonoKote on the top surfaces and orange MonoKote on the bottom. Chrome mylar trim is used on the leading edge for visibility and directional reference. You will be surprised how effective these strips are when the plane is a dot in the sky—and with this plane, that's high!

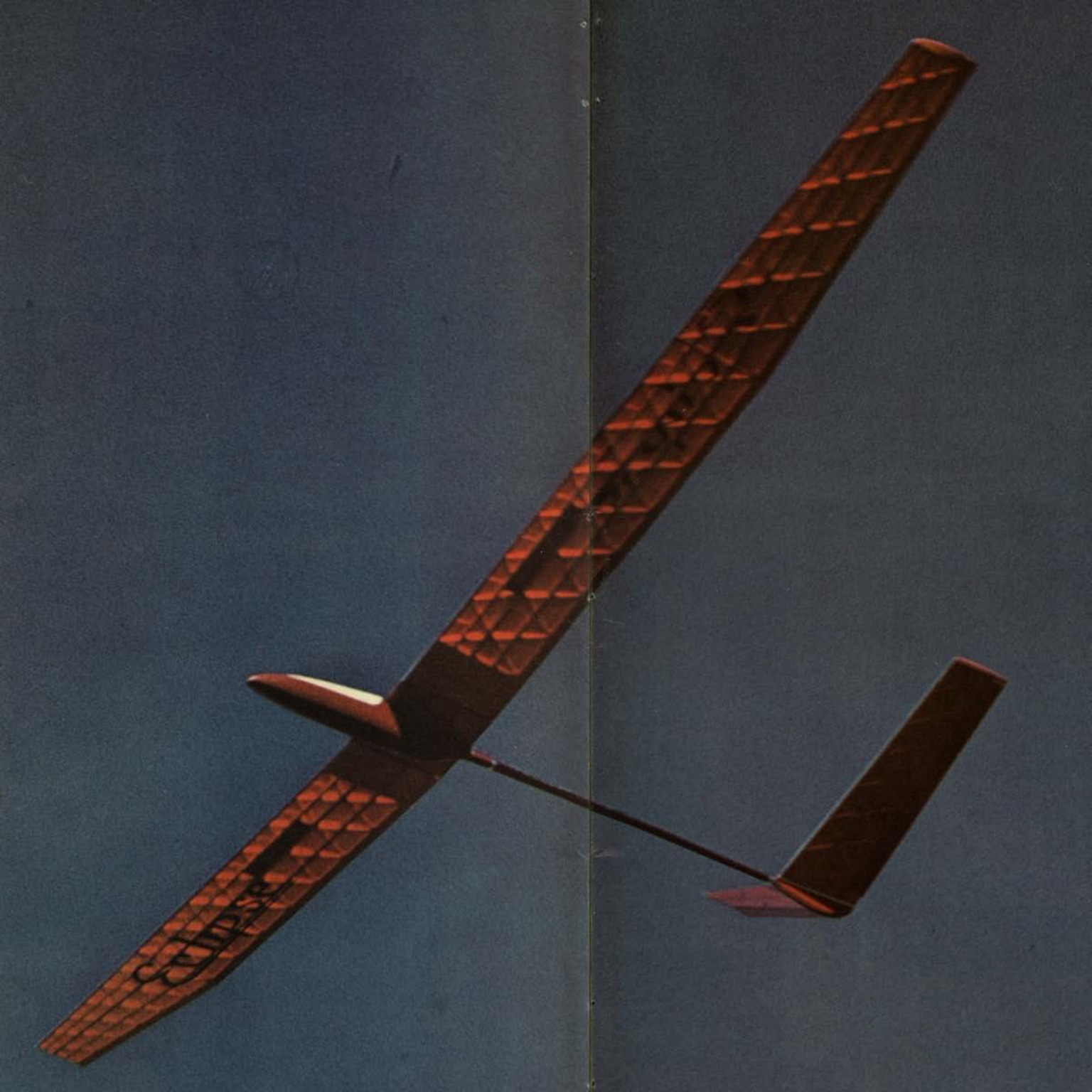
Flying: Balance the plane to obtain a flat, straight glide with all trim adjustments set in neutral. Use the CG shown on the plans for a reference. Balance may take as much as 12 ounces of lead, depending on your construction weight and RC gear.

With this flight setup, you will find full right or left trim, along with full up trim, will give you a nice circle for hands-off thermal soaring.

Good luck with your Eclipse and, if you have half as much pleasure from your plane as I have, you will agree that the work building it was well worth it.

A beautiful study in sailplane aesthetics, the Eclipse is elegant and spirited in flight.




Eclipse